

Chapter 24

A proposed live coral exhibit for Chester Zoo Aquarium

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ABSTRACT

Architects are currently working on the concept design for a new aquatic habitats centre at Chester Zoo to replace the existing aquarium. One of the key exhibits at this facility will be a live coral display. This coral exhibit will be unusual, but not totally unique in its design, and large compared to the majority found in other establishments.

The design of the coral exhibit presents a number of challenges, particularly regarding accessibility for aquarists carrying out maintenance duties and other husbandry tasks. Linking the exhibit to life-support and construction of habitat will present further challenges. Overcoming these problems is the topic of this presentation.

It is hoped this exhibit, like the majority of others at Chester Zoo, will be directly linked to a Chester Zoo *in-situ* project. In this case, the link will be to a collaborative conservation initiative in the Philippines. It will be based on a recently discovered Philippine reef system surveyed off the coastline of some small islands in the Polillo Group.

INTRODUCTION

As part of a proposed new aquatic environment complex at Chester Zoo, preliminary designs have been drawn-up for a specific living coral reef exhibit. The vision for this exhibit is to offer an exciting view into what life is like on and around a coral reef, but will also sensitize visitors about conservation issues and what can, and what is, being done to address them. The focus for this exhibit will be a specific reef around the coast of the Polillo Group of islands in The Philippines, a region in which Chester Zoo has close association with a number of conservation partners. One such important partnership is with the Polillo Islands Biodiversity Conservation Foundation Incorporated (PIBCFI) where, in connection with Fauna and Flora International (South East Asia), Chester Zoo supports a warden scheme. Involvement in this program includes the implementation of nine wardens that are responsible for monitoring a number of forest areas where there are many endemic species of birds, reptiles, amphibians and plants.

With Chester Zoo's increasing commitment to supporting *in-situ* conservation, there has

been a growing emphasis with new capital developments within the zoo to directly link what is exhibited *ex-situ* with what is being supported *in-situ*. All the key exhibits in the concept design for the new aquatic complex will focus on programmes the zoo is supporting and/or is actively involved with.

EXHIBIT THEME

The exhibit will focus on life on coral reefs around the Polillo group of islands in The Philippines. This choice is based on the discovery of a substantial reef system during a Chester Zoo field trip, which was actually researching freshwater fishes at the time. An excursion snorkelling off a couple of very small islands found evidence that there must be an extensive reef system in that locality. This information was passed on to Fauna and Flora International (FFI) in South East Asia, who in turn passed it on to Coral Cay Conservation (CCC). Scientists and organizations such as CCC had long thought there must be what was referred to as a "mother reef" somewhere in

vicinity of Polillo, but previous field trips had not found anything substantial.

Based on the evidence given, CCC agreed to carry out an extensive survey of the area, which they did during September 2006. They did find some very substantial reefs, particularly near the location described to them, but they also found in neighbouring localities quite extensive areas of reef that had been destroyed by dynamite fishing. A very useful and informative report was published by CCC soon after the survey. It is evident that further research and monitoring of the area will be necessary and tentative plans have been made to this end.

REQUIREMENTS

As part of the initial exhibit design remit, the following points had to be taken into consideration:

- The creation of a comprehensive representation of a living coral reef.
- A concentration on reefs around the Polillo Islands in The Philippines.
- Inclusion of links to organizations working in the Polillo region.
- Incorporation of engaging interpretative and graphic material.

Further exhibit requirements included;

- The need to house a wide range of organisms from small fishes and invertebrates to large species with low risk of predation.
- The engagement of visitors with a realistic view of a reef.
- Furthering visitors' knowledge of coral reefs, their conservation status and solutions for the future.
- Operation of the entire new complex through renewable and sustainable means, including the utilization of ground source heat pumps, solar and wind energy, etc.

Initially, the general consensus was that such exhibits as shark tanks would not be included within the complex. However, after much consideration it was decided that an exhibit purporting to reasonably represent life on and around a coral reef would not be complete without including its predators. This presented

zoo staff, architects and designers with a number of problems. Of chief importance was the issue of providing adequate space, both in terms of where the shark tank would be situated and living space for the animals themselves. Another concern was how to combine predatory species with those they would normally prey upon. The Black-tip reef shark, *Carcharhinus melanopterus*, was chosen for its relatively small size, iconic form, activity and penchant for spending its time up in the water column. This species has a good record for successfully combining with other species of fishes with low risk of predation, as they can be trained to take food from aquarists.

The next obstacle involved providing enough space for the sharks in an exhibit including substantial rockwork formations and live corals. The solution came from an earlier exhibit idea.

THE IDEA

Previously, the New England Aquarium was able to establish a living coral reef exhibit including the jellyfish, *Mastigias papua*. This combination was achieved by including a sealed acrylic window partition to create two tanks within one. The result was that visitors could look at the live corals and then beyond, through the acrylic window to the rear section where the jellyfish resided. This effectively created the illusion that they resided within the same tank (figure 1). This idea was included in the concept planning for the Chester Zoo Aquarium, but on a much larger scale with the sharks and other large fishes in the rear tank.

DEVELOPMENT

The first stage in the design process was to produce basic drawings of the idea, which were created by zoo staff. However, these initial drawings were not very dynamic and lacked imagination. Experienced aquarium architects were hired to design the new aquatic complex and they were able to produce plans for this particular exhibit that perfectly illustrated the vision.

The first architects' sketch (figure 2) offered a much more dynamic proposal with extra viewing windows that would provide very different scenes of what is living in the exhibit.

Although the overall complex would be largely illuminated by natural light, it was decided that this coral reef exhibit should provide a darkened public area in order to provide contrast and drama. Other exhibits in the complex would give visitors the opportunity to imagine they were exploring the various habitats personally.

The same is not possible for the reef exhibit, so it was decided that visitors should be in a dim environment with no distractions other than views of the corals and other animals. Figure 2 illustrates the visitor area in relationship to the exhibit and staff access above the tank. The concept design for the aquatic complex



Figure 1: Living coral reef exhibit including the jellyfish, *Mastigias papua*

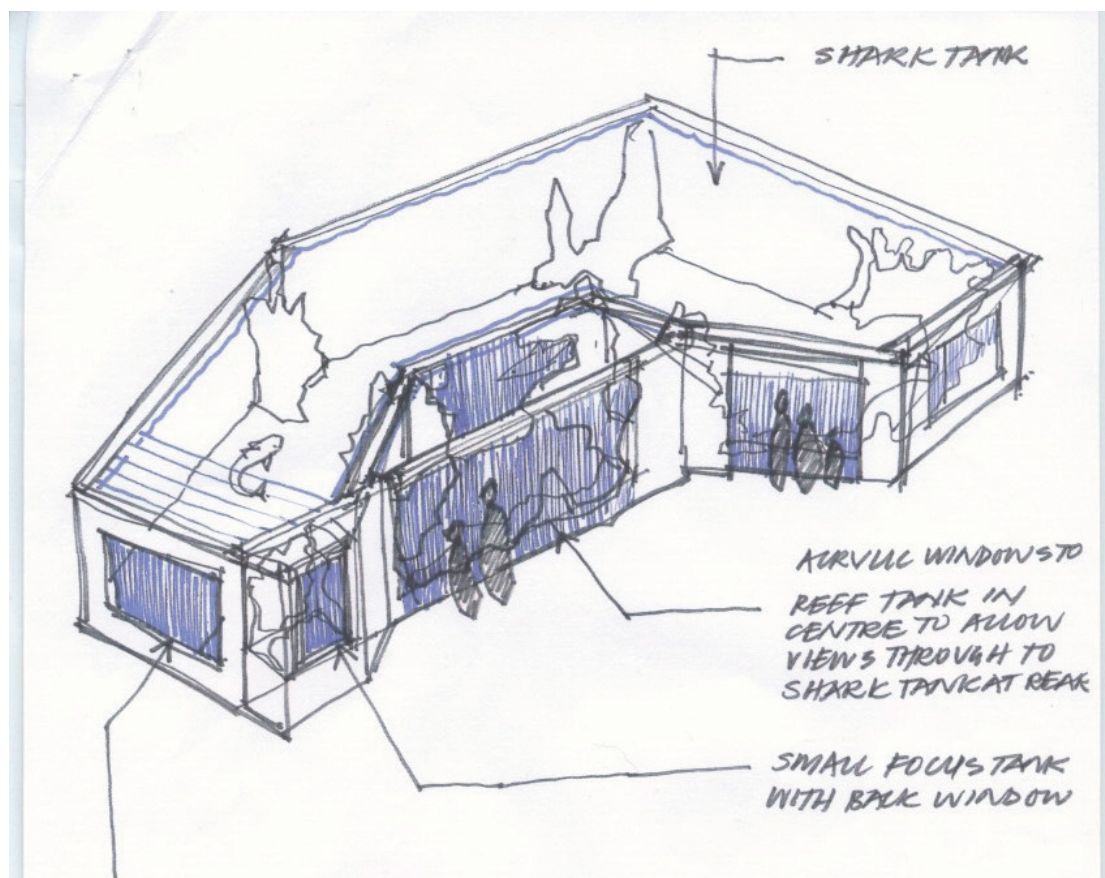


Figure 2: The first architects' sketch (Buttress Fuller Alsop Williams Architects)

included significant areas of transparent roofing, which would facilitate the provision of natural light to the exhibit. The roofing system selected was a multi-layer Ethylene Tetra Fluoro Ethylene (ETFE) material where the middle layer consisted of an adjustable mesh that could be controlled to adjust the amount of light being let through. If the mesh was closed, less light would get through, allowing for the reduction of light levels on very bright days and *vice versa* on dull days. Supplementary lighting would also be included, provided by low energy LED illumination.

(Note: Experiments are currently being undertaken to determine the efficiency/efficacy of LEDs at different water depths and, although proper conclusions have yet to be made, this type of lighting looks very promising.)

LIFE-SUPPORT

Because there are two separate environments associated with this exhibit there will have to be two life-support systems. The different requirements of the animals in each tank dictate this requirement. As far as the living coral element is concerned, the majority of filtration will be biological and achieved by the numerous living processes inhabiting this system. However, the addition of a foam fractionator will aid water clarity and the reduction of dissolved organic carbons (DOC) etc. Other processes intended to be employed will likely be calcium and carbon dioxide (CO₂) injection and some means for excess nitrate (NO₃⁻) removal. A plenum system may well be utilized within this exhibit module.

With regard to the shark element of the exhibit, a much different approach to the life-support will be taken. This particular tank will have much larger demands, with its associated build-up of biological chemicals, and therefore, the life-support will be somewhat more "hi-tech". Along with a suitably sized foam fractionator, UV algae control and high pressure sand filter for water polishing, a relatively new design of mechanical/biological filter will be utilized. The Nexus filter system is almost a hybrid between a conventional biological filter utilizing plastic media and a fluidized bed filter. Its relatively long-term use on existing Chester Zoo freshwater exhibits has proven its exceptional efficiency in both nitrification and de-nitrification and with

a change in some of its construction materials, such as using titanium or plastic where there are metal parts, it will do equally well in a marine aquarium application. The Nexus also performs as an efficient mechanical filter too. An advancement in plastic biological media technology that the Nexus system employs is a 5 cm honeycombed wafer disc called the Bio-Chip. More conventional media utilize nitrifying bacteria, but the honeycomb structure within the disc allows water to be trapped with slow exchange where numerous species of rotifers and other organisms that are larger than bacteria reside. These organisms take up suspended matter and perform other processes that have a profound and positive effect on water quality.

ACCESSIBILITY ISSUES

The space this exhibit will occupy within the aquatic complex and its relationship to public areas has caused some concern regarding staff access into the tank for husbandry duties. Access from above the tanks has proven to be the only viable means, and a series of fibre-grate gantries will be provided. From these gantries staff will be able to clean windows with pads on long poles within a general routine, however habitat structures within the tanks will be constructed in a way to allow personnel to enter the tanks for regular, more thorough cleaning of windows and substrata. Figure 3 illustrates the over tank access for maintenance.

EXHIBIT IMPACT

The Marine Aquarium Council (MAC) is an organization that is also interested in the same geographical area, particularly as there are fishing villages collecting specimens for the aquarium industry. Some of these fishing villages are undoubtedly responsible for the dynamite destruction in the region. One village where fishes are being collected for the ornamental trade is Carlagan and MAC is working toward providing a training programme for the fisher-folk there, where sustainable harvesting will be covered as well as good practices in handling and shipping. Successful villages are awarded MAC Certification, which links them to a chain of certified shippers, aquarium wholesalers and retailers. A new proposal to certify professional end users, such as public aquaria could complete the chain of ethical trade in marine

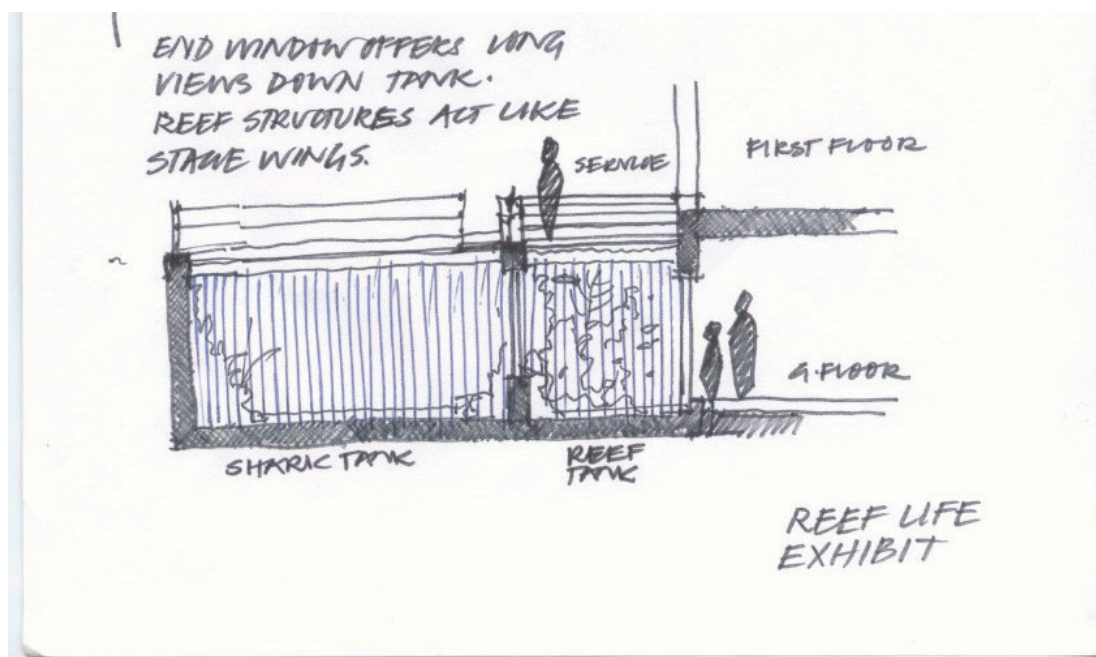


Figure 3: The over tank access for maintenance (Buttress Fuller Alsop Williams Architects)

aquarium fishes and invertebrates. Successful accreditation means that these fisher folk have gained the skills to operate a sustainable collecting business within the MAC chain and no longer need middle men, who are often corrupt. This dramatically improves their earning potential. End users gain in the knowledge that the specimens they buy have been collected with the long term conservation of coral reefs in mind and the fact that handling, packaging and shipping of the livestock has been carried out to an internationally agreed high standard.

The potential to link the reef exhibit to the activities of MAC and CCC are great. Although there has yet to be discussion and agreement on this from a number of parties, the benefit for visitors could be an opportunity to learn about positive efforts in coral reef conservation through the associated graphics and interpretation. Regular visitors to the zoo could actually monitor progress over time and gain a much deeper understanding of the situation.

CONCLUSION

The intention of the reef exhibit is to give visitors a dynamic view of what life is like on a Pacific coral reef as well as to improve their understanding of conservation issues and what can be done to address and resolve problems. With this approach it is hoped visitors will be

enthralled by the immersive experience they have had and continue to think about what they have seen and learned for some time into the future. Perhaps some visitors will be inspired enough to start actively supporting the organizations involved with the exhibit or any others that are operating in a similar area of conservation.

ACKNOWLEDGEMENTS

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For detailed information about Nexus filters please visit their website at <http://www.evolutionaqua.com>